

The Government Committee on the Chemical Trades is composed of men who will command the confidence of everyone, and their recommendations will have great weight. It must not be forgotten, however, that nearly all trades would be benefited by scientific help. The attitude of mind induced by scientific education is just the one required for the successful development of a business. If the manufacturers as a whole would realise this, they would see to it that their sons or those who are to carry on their business, have a thoroughly good scientific education, such as may now be got at many of the Universities and technical colleges in the country. It is not the classical or the modern side of our schools which is going to supply the successful manufacturer of to-morrow, it is the side where a man is taught to bring all his useful knowledge to bear on the achievement of success. Mr. Illingworth's book is the most successful attempt which has been made to explain the situation, and we believe that if the Government would send a copy of the book to each manufacturer in the country, the cost would be a mere nothing compared with the effect which would be attained.

OUR BOOKSHELF.

A Little Book on Map Projection. By Mary Adams. Pp. viii+108. (London: George Philip and Son, Ltd., 1914.) Price 2s. net.

It is very satisfactory to find that at the present time care is being taken that the principles of map projection are being studied as soon as the use of maps is seriously undertaken. At one time this part of their subject was much neglected by geographers, and left to those whose mathematical aptitude was especially developed. In this book Miss Adams aims at meeting the needs of the secondary and the higher elementary schools; and in clear and simple language sets forth the difficulties of an adequate cartographical representation of the earth's surface. Simple explanations are given of the principal types of projection, and then the distortion of the original spheroidal surface when it is represented on a plane surface is explained, and the compromises which have to be adopted are set forth. After this preliminary exposition, into which no mathematics enter, there follows a more detailed discussion of the principal zenithal, conical, and cylindrical projections, as well as certain special projections. These are illustrated by diagrams, and the explanation which is given of each should enable anyone to obtain a clear idea of the essential character of each kind.

A short appendix gives a more mathematical account of Mercator's, the Zenithal, and Mollweide's projection, but with this exception no demand of any but elementary mathematical knowledge is made upon the reader.

A short bibliography, which might be usefully extended by the inclusion of some well-known

German and Italian works, shows the student where he may find a more advanced treatment of the subject. The book is carefully written and well adapted to those for whom it is intended, and, while it cannot give them that complete knowledge of the subject which mathematical treatment alone can supply, it will pave the way to an intelligent appreciation which is of the utmost value to all who use maps.

Chemical Engineering: Notes on Grinding, Sifting, Separating and Transporting Solids. By J. W. Hinchley. Pp. viii+103. (London: J. and A. Churchill, 1914.) Price 2s. 6d. net.

In this series of articles, reprinted with some additions from the *Chemical World*, Mr. Hinchley provides, for the use of students intending to take up chemical engineering, a concise and practical outline of a subject of wide scope. The articles are illustrated with seventy sketches and diagrams, and their thoroughly practical character will be much appreciated by students of this branch of technology.

LETTERS TO THE EDITOR.

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Fizeau's Experiment and the Principle of Relativity.

It is well known that the principle of relativity gives for the velocity of light in a moving medium the expression

$$\frac{c}{\mu} + kv, \text{ where } k = \left(1 - \frac{1}{\mu^2} - \frac{\lambda}{\mu} \frac{\delta \mu}{\delta \lambda}\right)$$

where v is the velocity of the medium, and c/μ is the velocity when at rest. The repetition of Fizeau's experiment by Michelson and Morley gave for water the value 0.434 ± 0.02 for the coefficient k , whereas the value of the theoretical coefficient, taking the known values of μ and λ for sodium light, is 0.451 , which is well within the limits of the possible error.

The experiments of Gutton (*Journ. de Phys.*, ii., p. 196, 1912) show clearly that in the case of a very dispersive medium like carbon disulphide the velocity of propagation of nearly homogeneous light is the group velocity; and not that of an absolutely monochromatic train of waves. If this is universally true, as Lord Rayleigh and Gouy have predicted, then in the expression for the convection-coefficient k , the symbol μ must stand for the ratio of the velocity of light in free space to the group velocity. If we call the ordinary coefficient of refraction μ_0 , we have

$$\mu = \mu_0 \left(1 - \frac{\lambda}{\mu_0} \frac{\delta \mu_0}{\delta \lambda}\right);$$

neglecting the square of $\frac{\lambda}{\mu_0} \frac{\delta \mu_0}{\delta \lambda}$ (i.e. of 0.014) and terms of the same order, we have

$$k = 1 - \frac{1}{\mu_0^2} - \frac{\lambda}{\mu_0} \frac{\delta \mu_0}{\delta \lambda} - \frac{2\lambda}{\mu_0^3} \frac{\delta \mu_0}{\delta \lambda} + \lambda \frac{\delta}{\delta \lambda} \left(\frac{\lambda}{\mu_0} \frac{\delta \mu_0}{\delta \lambda}\right)$$

If we take the dispersion-formula of Ketteler and calculate the values of the two last terms in this

expression, we find that they are respectively $+0.016$ and $+0.022$, so that the theoretical value of k becomes $6.451 + 0.038$, that is, 0.489 . This even is in worse agreement with the experimental value 0.434 than the value 0.451 usually given, but a consideration of the experimental conditions shows that the value to be deduced is in reality 0.492 , which is in excellent agreement. The argument will shortly be published in full.

E. CUNNINGHAM.

St. John's College, Cambridge, October 14.

Flint Fracture.

It is to be regretted that the letter of Mr. Reid Moir in *NATURE* of September 24 has received no reply. If chemists, mineralogists, petrologists, and physicists could have been made to realise the fruitful fields for profitable and far-reaching research opened to them by this subject, our knowledge would be in a very different state to-day, and many of the contentions and mysteries would be replaced by demonstrable facts.

In all text-books we see descriptions, or references, to lydite, the touchstone of the goldsmith, and in museums and collections we see specimens bearing this name; all kinds of origins are claimed for it; sedimentary, volcanic, metamorphic, and one has even seen meteoric. In text-books we see descriptions of the pebbles in the Blackheath beds; we are told they are pebbles of flint still retaining their original black colour. As a matter of fact, they are not black flint; they are now of various colours. It is their surface that is black; the metamorphosed portion may not be thicker than tissue paper, but other examples can be found upon a sea-beach where it is an eighth of an inch thick, and from this onward until the whole is metamorphosed, and we have the jet-black mineral, which does duty under the name of lydite!

Just one more example. The same text-books describe the beautiful "Egyptian jasper"; some say the locality from which this has been derived is unknown; others venture to suggest one. One of the many metamorphoses of flint is jasperisation. We see this commence on the surface of flints (one of the things called patination); this proceeds in intensity and centrewards until the whole substance is altered, and we have the rich mottlings of yellows and browns, quite equal to those of Egypt. The so-called Egyptian jasper may be a metamorphosed British flint.

Mr. Reid Moir refers to lines radiating from the point of percussion on the fractured face of a flint; here is something for the physicist; they certainly are not "fissures," but rather lines of force (closely connected with faceted cones and stellate fracture). The best place to see these, and study them, is in asphalt or pitch. So long as the "fracture-" or "flaking-plane" maintains itself constant, *i.e.* in relation to the striking-plane, they remain fairly simple. If, however, the fracture-plane resolves, or even undulates very deeply, then a very remarkable phenomenon obtains, and the lines end in a row of cones just over the escarpment, looking like a row of pointed tents with a rope passing from the centre pole of each to the point of percussion!

The last weeks of Sir John Evans, before he took to his final bed, were spent in studying a large collection brought together to put the whole subject of lithoclasiology on a scientific footing. His last words to the collector were: "Promise me that if I do not pull through this operation, you will lose no time in publishing all this. I am certain that this is where we ought to have started sixty years ago, and no real progress will be made until we start here."

If we take half a dozen pieces of flint of exactly the same shape and size, and apply exactly the same force, administered in exactly the same manner, and of exactly the same intensity, the results may be very different in each case. Before we can argue from the effect to the cause, we must know something about the nature of the object acted upon. We must start with the origin and nature and varieties of silica, the various metamorphoses and molecular rearranging to which each variety is subject, and how each variety, in each state, responds to dynamic agency, whether administered by nature or man.

So also when we come to dynamics we must study every mechanical possibility, single them out, and name them, so that every observer may know what the other is speaking about. There must be no "peculiarities known only to the student," and "no features known only to myself." Each phenomenon must be capable of separate study, and receive a special name, so that all understand what they are talking about.

There are few who appreciate the splendid work which Mr. Reid Moir has been doing more than myself, but I am quite sure that if he were to restart the subject, on the lines here indicated, in a very short time he would regard the points he raises with very different eyes.

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8 Grand Parade, St. Leonards-on-Sea.

Filtering Power of Sand.

THE letter of Mr. C. J. Watson in *NATURE* for October 15, recommending that "Nachtblau" (night-blue) should be used for experiments on adsorption by sand, leads us to point out that so far back as 1909 we demonstrated before the International Congress of Applied Chemistry (Section IV.B, p. 7) the striking experiment in which a solution of this dye issues perfectly colourless after passing through a column of purified sand. Since this date the experiment has been frequently used for demonstration purposes at lectures on adsorption by ourselves and others.

We showed in 1909 the remarkable quantitative relations existing between the weight of sand and the weight of dye absorbed; each degree of fineness of the sand is characterised by a remarkably sharp co-efficient of adsorption, the value $\frac{\text{weight of dye adsorbed}}{\text{weight of sand}}$

being constant for the same sand to the sixth decimal place (in one series, for example, values 0.000147 to 0.000148 being obtained). The relation of these experiments to the general theory of dyeing was dealt with in the paper cited, and also in a later communication to the Society of Chemical Industry (1912, vol. xxxi.).

W. P. DREAPER.

W. A. DAVIS.

Scientific Societies and the War.

SUGGESTIONS have recently been made that certain of our scientific societies should suspend their meetings for the present, on the ground that "it is difficult to take an interest in such things just now." To those who share this feeling, it may be worth while to point out that, as already recorded in *NATURE*, the Académie des Sciences held its usual meeting Paris on September 7. Under that very date, in the *Times* review of the war for September, we find the entry, "Germans reach the extreme point of their advance." Among our gallant Allies, at all events, "le tour d'ivoire ne se rend pas."

W. T. CALMAN.

British Museum (Natural History), October 16.